Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

JAMES FRANKLIN COLLINS
CHARLES ALFRED WEATHERBY } Associate Editors
LUDLOW GRISCOM

Vol. 38. March, 1936. No. 447.

CONTENTS:

The New England Botanical Club, Inc.
8 and 10 West King St., Lancaster, Pa.
Room 1001, 53 State St., Boston, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of New England. Price, $2.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) 20 cents. Volumes 1–8 or some single numbers from them can be supplied only at advanced prices which will be furnished on application. Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be considered for publication to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than two pages of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to
M. L. FERNALD, 14 Hawthorn Street, Cambridge, Mass.

Subscriptions (making *all remittances* payable to RHODORA) to
Ludlow Griscom, 8 W. King St., Lancaster, Pa., or Museum of Comparative Zoology, Cambridge, Mass.

Entered at Lancaster, Pa., Post Office as Second Class Mail Matter.

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 38. March, 1936. No. 447.

A STUDY OF FIVE NEW ENGLAND SPECIES OF SCAPANIA[1]

Alexander W. Evans

The writer in 1930 discussed "three species of *Scapania* from western North America" (**6**) from the standpoint of the ideas expressed in Buch's recent monograph on the Scapaniaceae of northern Europe and Siberia (**4**). The same method is employed in the present paper, which considers five species of *Scapania* from New England. The species in question are *S. gymnostomophila, S. apiculata, S. curta, S. mucronata,* and *S. lingulata.* These species are by no means confined to New England but have an extensive distribution, for the most part circumboreal.

The family Scapaniaceae, as defined by Buch (**4**, p. 10), includes the following genera: *Douinia* Buch, *Diplophyllum* Dumort., *Scapaniella* Buch, *Scapania* Dumort., and *Blepharidophyllum* Ångstr. Of these genera *Douinia,* with the single species *D. ovata* (Dicks.) Buch, is confined in North America to the Pacific Coast region, and *Blepharidophyllum* is distinctly antarctic. The other three genera are all found in New England. The distinctions between *Scapania* and *Scapaniella,* represented in North America by *S. glaucocephala* (Tayl.) Evans, will be commented upon by the writer in another connection. Those between *Diplophyllum* and *Scapania* may now be briefly reviewed.

In most recent works on the Hepaticae the main distinctions between these genera are drawn from the perianth. This organ, in typical species of *Scapania,* is strongly compressed, with sharp lateral

[1] Contribution from the Osborn Botanical Laboratory.

keels; the dorsal and ventral surfaces, moreover, lack supplementary folds, and the mouth is not contracted. In *Diplophyllum*, on the other hand, the perianth is less strongly compressed and is bounded laterally by rounded folds, additional dorsal and ventral folds are present (at least in the upper part), and the mouth is distinctly contracted. In Buch's monograph the main distinctions between these two genera are drawn from the leaves. In typical *Scapaniae* these are keeled throughout; in other words the two lobes meet at a definite angle, which is most clearly shown by cross-sections. In *Diplophyllum*, however, the leaves, although keeled above, are not keeled below, and a cross-section shows a broad open curve. The unkeeled portion extends about half-way to the sinus between the lobes and forms a more or less distinct sheath around the stem.

In most of the species belonging to the genera in question the *Scapania* type of leaf is associated with the *Scapania* type of perianth and the *Diplophyllum* type of leaf with the *Diplophyllum* type of perianth. There are a few species, however, in which the *Scapania* type of leaf is associated with the *Diplophyllum* type of perianth, and these have sometimes been referred to *Scapania* and sometimes to *Diplophyllum*. Buch refers all such species to *Scapania* but separates them subgenerically from the more typical members of the genus. The only New England species falling into this doubtful category is *S. gymnostomophila*, for which Buch proposes the new subgenus *Kaalaasia*, named in honor of B. Kaalaas, the author of the species. All the other species of *Scapania* found in New England are referable to his subgenus *Euscapania*.

One of the most noteworthy features of Buch's work on *Scapania* (3) is his use of pure culture methods. By cultivating certain species under varying conditions of light and water-supply he has been able to show that marked differences in the appearance and structure of the plants may be directly due to differences in these external factors. Many types of *Scapaniae*, which represent such responses to the environment, occur in nature, and some of these have been distinguished in the literature, sometimes as forms, sometimes as varieties, and sometimes even as distinct species. Buch, however, would apply the term "modification" to all such environmental fluctuations and would not regard them as definite taxonomic entities. He would reserve the terms form, variety, and species for types transmitted by heredity and therefore essentially different from environmental responses. As examples of his modifications, which are more or less

alike in different species, it will be sufficient to mention "mod. *viridis*," with leaf-cells having colorless cells-walls, caused by diffuse light; "mod. *colorata*," with leaf-cells having pigmented cell-walls, caused by exposure to direct sunlight; "mod. *leptoderma*," with thin-walled leaf-cells, caused by a complete (or almost complete) absence of transpiration; and "mod. *pachyderma*," with thick-walled leaf-cells, caused by excessive transpiration.

Buch's work emphasizes further the importance of certain histological features of the stem and leaves in distinguishing species. In the stem, as seen in cross-section, a small-celled cortex, varying in different species from one to five cells in thickness, and a large-celled medulla can be distinguished. The cells of the cortex may be thin-walled or thick-walled, according to the environment, and any deposits of thickening lining the cell-cavities are more or less uniform. The cells of the medulla are usually thin-walled throughout but occasionally show minute thickenings at the angles. In the leaves a marginal band, one or more cells wide, is characteristic of certain species. The cells of this band, in its most usual development, have uniformly thickened walls and thus stand in contrast to the interior cells, which have localized thickenings at the angles. Unfortunately bands of this character, although distinctive of certain species, are not necessarily of constant occurrence. In the variable *S. undulata* (L.) Dumort., for example, well-marked bands are present in mod. *pachyderma*, but in the submerged and more usual mod. *leptoderma* the leaf-cells are thin-walled throughout.

Of the cell-contents Buch emphasizes the importance of the fat-bodies from the standpoint of the taxonomist and notes that their development is but little influenced by external factors. The fat-bodies, when different species are compared, show differences in size, in color, and in the number present in each cell. In most cases fresh material is necessary for their study, since they tend to disintegrate after death and often disappear completely. In a few species, however, they are more persistent and can be demonstrated even in old herbarium specimens.

The five species to be discussed are among the smallest members of the genus. As already noted Buch places *S. gymnostomophila* in the subgenus *Kaalaasia* and the other four species in the subgenus *Euscapania*. Of these four species *S. apiculata* is referable to Buch's section *Apiculatae*, and *S. curta*, *S. mucronata* and *S. lingulata* to his section *Curtae*. Eight additional species of *Scapania* have been found

in New England, and these illustrate four of Buch's other sections of *Euscapania*.

1. Scapania gymnostomophila Kaalaas, Bot. Not. **1896**: 21. *Diplophyllum gymnostomophilum* Kaalaas, Vidensk.-Skrift. I. **1898**[9]: 4–9. *f. 1–4.*

In calcareous regions, mostly on limestone cliffs in association with other bryophytes.

Maine: Round Mountain Lake and vicinity, Franklin County, 1916 (*Miss Lorenz*), listed in Rhodora **19**: 272. 1917, as *Diplophyllum gymnostomophilum.*

Vermont: Rochester, 1910 (*Dutton*), determined by Buch, listed in Rhodora **14**: 224. 1912, as *Scapania curta;* Willoughby, 1913 (*Miss Lorenz*), listed in Rhodora **16**: 72. 1914, as *Diplophyllum gymnostomophilum;* same locality, 1917 (*Miss Lorenz*); Smuggler's Notch, 1917 (*Miss Lorenz*); Quechee Gulf, Hartford, 1921 (*Miss Lorenz*).

The following North American stations outside New England may also be cited:— Ellesmere Land: Havnefjord and Isachsens Fjord, King Oscar Land, 1898–1902 (*Simmons*), listed by Bryhn in Report Second Norwegian Expedition in the "Fram" **11**: 47. 1906, as *Diplophyllum gymnostomophilum.* Nova Scotia: Middle Harbor, Dingwall, 1917 (*Nichols*). Wisconsin: Black River, Douglas County, no date (*Conklin*). The species is widely distributed in northern and central Europe and also in Siberia.

The writer (**6**, p. 71) has already called attention to some of the more important features of this interesting species and to the divergent views which have been held regarding its systematic position. As already noted Buch places it in *Scapania,* rather than in *Diplophyllum,* because its leaves do not conform to the *Diplophyllum* type. The monotypic subgenus *Kaalaasia,* which he proposes for its reception, is characterized not only by its plicate perianth but also by its small dorsal lobes, which rarely extend to the upper margin of the ventral lobes; and by its peculiar fat-bodies, which are brownish and unusually large for the genus. In most cases these fat-bodies occur singly in the leaf-cells and occupy the greater part of the cell-cavity. It is only along the margin, toward the bases of the lobes, and in the apical portions of gemmiparous leaves that they are sometimes found in pairs or clusters. The fat-bodies persist for a long time in herbarium specimens but eventually disappear.

Buch emphasizes also, as a subgeneric character, the entire margins of the leaves and states that this condition prevails even in the case of gemmiparous leaves. In the subgenus *Euscapania,* on the other hand, many of the species have toothed leaves, and even those in

which the lobes are normally entire tend to develop teeth on the leaves of gemmiparous branches. Apparently, however, Buch lays undue emphasis on this particular difference, since the leaves of *S. gymnostomophila* are not invariably entire. In the writer's experience minute denticulations, each consisting of a single projecting cell, are occasionally produced and seem to be associated in some way with the production of gemmae. These denticulations, which have been observed in both European and American material, may have thin walls, but in other cases their walls are thickened and thus resemble the outer walls of ordinary marginal cells. Although in most of the plants examined an individual leaf rarely produces more than one or two denticulations, some of the leaves in the Nova Scotia plants produce from four to eight.

The leaf-lobes in *Kaalaasia* are usually pointed, although the ventral lobe in some cases is rounded. The point consists of a single cell or in rare instances of two cells, and the outer wall is either thin or thickened, thus resembling the outer walls of the marginal denticulations. Buch describes the leaf-cells as everywhere "collenchymatous." The trigones, however, as shown by his figures, usually have concave sides and may be minute and indistinct. According to Kaalaas (**8**, p. 5) the cortex of the stem is composed of two or three layers of cells with thickened brownish walls. According to Buch the cortex consists of a single layer of flattened cells with uniformly thickened walls, which are distinctly smaller than the medullary cells, with the possible exception of those adjacent to the cortex. The discrepancy in these two accounts may be due to the fact that the walls of two or three of the outer medullary layers frequently show a brownish pigmentation.

The perianths of *S. gymnostomophila* are exceedingly rare, and very few have been observed. Kaalaas emphasizes the plicate feature and states that the mouth is contracted and finely dentate. A few of the specimens from Wisconsin show badly weathered perianths, agreeing in most respects with the published descriptions but showing short-ciliate, rather than dentate, mouths. According to Buch plicate perianths can occasionally be found in the section *Curtae* of the subgenus *Euscapania*, although in most species of this group the perianths definitely conform to the *Scapania* type. He thinks, therefore, that Kaalaas attached too much importance to this feature when he excluded *S. gymnostomophila* from *Scapania*.

The golden-brown, two-celled gemmae of *S. gymnostomophila*, with their thickened walls, are very helpful in distinguishing the species.

In most cases they are distinctly pointed at both ends and commonly show a fusiform outline, although deviations from this form are to be expected. In *S. curta* and its allies, with which the present species has sometimes been confused, the gemmae are usually green, except where exposure to direct sunlight produces a reddish pigmentation.

2. Scapania apiculata Spruce, Hepat. Pyrenaicae Exsic. 15. 1847; Ann. & Mag. Nat. Hist. II. **4**: 106. 1849.

On logs, often associated with other bryophytes.

Maine: Round Mountain, Franklin County, 1912 (*Miss Lorenz*), listed in Rhodora **14**: 224. 1912; Caribou, 1913 (*A. W. E.*); Megantic Preserve, Franklin County, 1916 (*Miss Lorenz*).

New Hampshire: Chocorua, 1906 (*Farlow*), listed in Rhodora **9**: 71. 1907; Flume and Franconia Notch, 1908 (*Miss Lorenz et al.*), listed by Miss Lorenz in Bryologist **11**: 114. 1908; Waterville, 1911 (*A. W. E.*); King's Ravine, Randolph, and Columbia, 1917 (*A. W. E.*).

The following North American stations outside New England may also be cited:—Manitoba: Manitoba House, 1881 (*Macoun*), listed in Rhodora **9**: 71. 1907. New York: North Elba, 1898 (*Peck*), listed by Peck in Bul. N. Y. State Mus. **6**: 178. 1899. Wisconsin: St. Louis Bay, Superior, 1905 (*Conklin*); Copper Creek, 1909 (*Conklin*); Wentworth, Douglas County, 1910 (*Conklin*); Stone's Bridge, Brule River, Douglas County, 1916 (*Conklin*). Minnesota: Spirit Lake, Duluth, 1907 (*Conklin*); Lutsen, Cook County, 1911 (*Conklin*). The specimens from Wisconsin and Minnesota, collected prior to 1914, have been listed by Conklin in Trans. Wisconsin Acad. **18**: 1004, 1005. 1914. So far as known *S. apiculata* is confined to old logs. It has a wide distribution in Europe and northern Asia, although far from abundant throughout the greater part of its range.

The writer has already published a short account of this distinct species (**5**, p. 71); but a summary of its more important features, including certain peculiarities brought out for the first time in Buch's description, may be of interest. The stem, as in all the *Scapaniae*, shows a differentiation into a cortex composed of small thick-walled cells and a medulla composed of larger thin-walled cells. The cortical cells, which are in one or two layers, are strongly flattened, much as in *S. gymnostomophila*, and their walls are pigmented with brown. According to Buch's measurements these cells are only 7–13 μ in radial width and thus stand in sharp contrast to the medullary cells, which are 27–43 μ in diameter.

Other distinctive features of *S. apiculata* are found in the leaves and in the mouth of the perianth. In the leaves both lobes are sharp-pointed, and the points consist either of a single cell or of a cell-row two or three cells long. The dorsal lobe is somewhat smaller

than the ventral and, in some cases, spreads away from it in a squarrose manner. The margins are usually entire but occasionally show one or two indistinct teeth. The leaf-cells are characterized by their large and conspicuous trigones, which are present even in the marginal cells, and by their verruculose or striolate-verruculose cuticle. The trigones in most cases have convex sides and may be coalescent. In each leaf-cell two to six fat-bodies are present and may persist even in herbarium material. These fat-bodies are much smaller than those of *S. gymnostomophila* and present a granular appearance. The mouth of the perianth is normally entire, although in rare instances a marginal cell may project as a vague crenulation or denticulation.

Other characters of importance are derived from the gemmiparous leaves and branches. Buch was the first to show that these structures are highly specialized. The leaves, for example, toward the tip of the branch become gradually rounder, and their lobes become gradually shorter until the sinus between them completely disappears. These leaves, instead of being keeled, are closely appressed to the axis; and the gemmiparous branches, the growth of which is sooner or later limited, thus acquire a flagelliform appearance. The unicellular gemmae of *S. apiculata* are brown in color and broadly elliptical in form. Flagelliform branches of the type just described, with specialized gemmiparous leaves, are apparently confined, in *Scapania,* to the section *Apiculatae.* Similar branches are found, however, in two species of the allied genus *Scapaniella:* the European *S. vexata* (Massal.) Buch and the North American *S. glaucocephala.*

3. Scapania curta (Mart.) Dumort. Recueil d'Obs. sur les Jung. 14. 1835. *Jungermannia curta* Mart. Fl. Crypt. Erlangensis 148. *pl. 4, f. 24.* 1817. *J. rosacea* Corda in Sturm, Deutschl. Fl. II. **23**: 96. *pl. 29.* 1832. *Scapania rosacea* Nees in G. L. & N. Syn. Hep. 71. 1844.

On soil, sometimes in exposed localities and often accompanied by other bryophytes. Most of the records for *S. curta* and the two following species are based on Buch's determinations.

Maine: St. John River, between St. John Pond and mouth of the Allegash River, 1917 (*Nichols*); determination somewhat doubtful, In his monograph (**4**, p. 61) Buch lists two specimens from Maine. without giving more definite data.

New Hampshire: shore of Peabody River, near Gorham, 1897 (*Farlow*); Jackson, 1902 (*A. W. E.*). Both of these stations are listed in Rhodora **4**: 212. 1902.

The following stations from other parts of North America may likewise be listed:—British Columbia: Asulkan Valley, 1908 (*Brink-*

man). Wisconsin: near Cornucopia, Bayfield County, 1907 (*Conklin*). California: Tuolumne Meadows, 1928 (*Mrs. Sutliffe*): Yosemite Park, 1928 (*Mrs. Sutliffe*). Buch lists the species also from Minnesota, but there are no specimens from the state in the Yale Herbarium. In Europe and northern Asia *S. curta* is widely distributed.

In the section *Curtae*, as defined by Buch, the relatively small plants vary in color from green to brownish or reddish. In the stems the difference in size between the cortical and medullary cells is less pronounced than in the *Apiculatae*. The cortex is composed of one or two layers of cells with thick walls usually pigmented with brown, but the cells are scarcely flattened and usually appear isodiametric in cross-section. The leaf-lobes are rounded or abruptly short-pointed at the apex, and neither lobe arches across the stem. The production of gemmae, which are usually developed in abundance, tends to inhibit the growth of the gemmiparous leaves, but the gemmiparous branches do not acquire a flagelliform appearance.

The *Curtae* have been the cause of much confusion to hepaticologists, and divergent views have been held regarding the identity of *S. curta* and its range of variation. In 1916 Buch (**2**) emphasized the fact that the leaves of the species, as understood by most authors, showed two distinct types of cell-structure. In the first type one or more rows of marginal cells have uniformly thickened walls, whereas the interior cells have trigones; in the second type all the cells, including the marginal, have trigones. Buch decided that the species was too broadly defined and that it might better be treated as a group of related species. In carrying out this idea he segregated *S. mucronata* and *S. lingulata* from the old *S. curta* as new species. Buch, however, was not the first to distinguish the two types of cell-structure in the leaves of *S. curta*. This had already been done by Lindberg as early as 1889 (**9**, p. 31). Lindberg, in fact, had divided *S. curta*, as ordinarily understood, into two species on the basis of this distinction. Plants showing the first type he referred to *Martinellia rosacea* (Corda) Lindb. & Arnell and retained the name *M. curta* (Mart.) Lindb. & Arnell for plants showing the second type. From the study of the specimens in the Lindberg Herbarium Buch concluded that Lindberg's *M. rosacea* really represented the true *Scapania curta* and that his *M. curta* included *S. mucronata*, *S. lingulata* and several other species (see **4**, p. 55).

Buch divides the section *Curtae* into the two subsections *Marginatae* and *Immarginatae*. The first of these, which includes *S. curta* as now

restricted, is based on plants having leaves with a border, in other words on leaves showing the first type of cell-structure; the second, which includes *S. mucronata* and *S. lingulata*, on plants having leaves with the second type of cell-structure. The border in *S. curta*, as he describes it, is one to four cells wide. On the outside the cell-walls are uniformly thickened but toward the inside the boundary of the border is vague, owing to the insensible gradation between the cells with uniformly thickened walls and the interior cells with trigones separated by thin cell-walls.

Aside from the bordered leaves *S. curta* is characterized by the rounded to subacute apices of the lobes, which are either entire or sparingly and irregularly toothed; by the denticulate mouth of the perianth with teeth one to three cells long; and by the green, two-celled, elliptical gemmae. The plants are usually green but may assume a reddish or brownish color in direct sunlight. The cortex is green in shaded localities but sometimes shows a reddish pigmentation even when the leaves remain green. In extreme cases the cortex becomes dark reddish brown. The trigones of the leaf-cells in the interior of the lobes have straight or slightly convex sides, but the cavities never present a stellate appearance.

The species is exceedingly variable and readily responds to changes in the environment. In mod. *mesoderma* and mod. *pachyderma* the leaf-borders are distinct, but in mod. *leptoderma* the borders may not be differentiated at all. This modification often occurs in plants with small and distant leaves, constituting mod. *parvifolia-leptoderma-laxifolia* of Buch; and similar modifications may arise in *Scapania irrigua* (Nees) Dumort., which resemble those of *S. curta* very markedly. It is often difficult, in fact, especially in dried material, to determine these leptodermous modifications positively.

4. Scapania mucronata Buch, Medd. Soc. F. et Fl. Fenn. **42**: 91. *f. 6, 9.* 1916; Comm. Biol. Soc. Sci. Fenn. **3**[1]: 63. *f. 14.* 1928. *Martinellia mucronata* Arnell & Jensen, Svensk Bot. Tidskr. **12**: 309. 1918.

On soil, decayed logs, or shaded rocks, often accompanied by other bryophytes.

Maine: Eastport, 1911 (*A. W. E.*); Fort Kent, 1913 (*A. W. E.*).

New Hampshire: Jackson, 1890 and 1898 (*A. W. E.*).

Massachusetts: Mt. Holyoke, 1903 (*Miss Lorenz*), listed as *S. curta* in Rhodora **6**: 190. 1904.

Connecticut: shore of Black Pond, Meriden, 1907 (*Miss Lorenz*), listed as *S. curta* in Rhodora **10**: 192. 1908; Mt. Carmel, Hamden, 1913 (*Miss Lorenz*); Killingly, 1926 (*Miss Lorenz*).

Buch, in his Monograph, cites the species from Vermont, but there are no specimens from this state in the Yale Herbarium.

The following stations from various other parts of North America may also be cited:—Greenland: Upernavik, 1834 (*Vahl*), cited by Buch; Manetsok, no date (*Warming & Holm*), also cited by Buch. Alaska: Yakutat Bay, 1899 (*Brewer & Coe*), listed as *S. curta* in Proc. Washington Acad. **2**: 312. 1900. Yukon: Hunker Creek, 1902 (*Macoun*), listed as *S. curta* in Ottawa Nat. **17**: 23. 1903. Nova Scotia: Aspy Bay, 1917 (*Nichols*), listed by Nichols as *S. curta* in Bryologist **21**: 28. 1918. British Columbia: Tetachuk, 1911 (*Brinkman*), listed by Arnell as *Martinellia curta* in Göteborgs Kungl. Vetenskaps- och Vitterhets-Samhälles Handl. 23. 1922. New York: island in Chilson Lake, 1901 (*Mrs. Smith*). Michigan: shore of Douglas Lake, 1920 and 1921 (*Nichols*), listed by Nichols as *S. curta* in Bryologist **25**: 47. 1922; Grand Island, Alger County, 1934 (*Nichols*), listed by Nichols in Bryologist **38**: 15. 1935. Wisconsin: Black River, Douglas County, 1909 (*Conklin*); Bayfield County, Lake Superior, 1924 (*Conklin & Wilson*). Minnesota: Chester Creek Park, Duluth, 1909 (*Conklin*), distributed as *S. curta* by C. C. Haynes, Amer. Hepat. 75; Knife River, 1909; Carlton, 1909 and 1911; Lutsen, Cook County, 1911; Thompson, 1911; Thompson Gorge, St. Louis River Dells, Carlton County, 1924. Oregon: Pigeon Point, 1931 (*Miss Sanborn*), listed by Brinkman in Rept. Prov. Mus. Nat. Hist. [Victoria, B. C.] 1934: 14. The specimens from Minnesota were all collected by Conklin; several of these specimens, together with the first specimen from Wisconsin, are listed as *S. curta* by Conklin in Trans. Wisconsin Acad. **17**: 1005. 1914. The species is widely distributed in Europe and northern Asia.

It will be seen from the specimens cited that many of the North American records for *S. curta* have been transferred to *S. mucronata*. In view of the wide range of variation hitherto assigned to *S. curta*, it is obvious that published records for the species ought not to be accepted without a re-examination of the specimens upon which they were based.

When Buch proposed *S. mucronata* as a new species he described the trigones of the leaf-cells as unusually large and stated that the cell-cavities, in consequence, were distinctly stellate. Arnell, in recognizing the validity of *S. mucronata* (**1**, p. 29), under the name *Martinellia mucronata*, took exception to this statement. According to his account the cell-cavities, in many cases, are rounded, and the trigones are not especially large. In his monograph (**4**, p. 66) Buch admits the force of Arnell's criticism and finds that the cavities are rounded in the relatively frequent mod. *mesoderma*. He states, however, that stellate cavities are present in the relatively rare mod. *pachyderma*, which grows almost exclusively on rotten logs. All the

North American specimens examined by the writer show trigones clearly, even in the marginal leaf-cells. In some cases the sides of the trigones are definitely convex and project slightly into the cell-cavities, thus producing a somewhat stellate appearance; but this appearance is unusual, since most of the trigones observed have straight or slightly concave sides. These specimens, therefore, for the most part, represent mod. *leptoderma*.

In distinguishing *S. mucronata* from the other representatives of the *Immarginatae* Buch emphasizes the following features: the relatively small size of the marginal leaf-cells, which measure only 13–20 μ in width; the usual absence of teeth along the margins; the obovate ventral lobes, usually rounded with a sharp apical tooth, but sometimes more gradually pointed; the presence of an apical tooth on the dorsal lobes; the lobed and fimbriate mouth of the perianth, which may be either plicate or wholly destitute of supplementary folds; the elliptical, oval, or narrowly triangular, two-celled gemmae, varying in color from green to reddish.

The apical teeth of the lobes, according to his account, consist of a row one to three cells long, and he implies that these teeth are constantly present. In the European material examined by the writer this seems to be literally the case, except in very rare instances, although some of the one-celled teeth project very slightly. In several of the North American specimens, however, the ventral lobes, to a greater or less extent, are broadly rounded at the apex and show no signs of apical teeth. This might indicate that *S. mucronata* was more variable than the descriptions imply or that the specimens in question were incorrectly determined.

At first thought the closely related *S. scandica* (Arnell & Buch) Macvicar (see Buch, **4**, p. 73) comes to mind. This species, which is widely distributed in Europe, is known also from Iceland and Greenland and is therefore to be expected in continental North America. It agrees with *S. mucronata* in several important respects but differs in its usually rounded ventral lobes, in the smaller trigones of its leaf-cells, and in the entire or very sparingly denticulate mouth of its perianth. Unfortunately the North American specimens with rounded lobes are mostly sterile. A single perianth, however, was detected in the material from Mt. Carmel, Connecticut, in which rounded ventral lobes are much in evidence, and this perianth is distinctly fimbriate at the mouth. This particular material, therefore, cannot be referred to *S. scandica*, and it seems best to retain it in *S. mucronata*, at least

until the range of variation in this species is better understood. The sterile specimens with rounded ventral lobes are likewise retained in *S. mucronata*, since they agree in all essential respects with the Mt. Carmel specimens.

Arnell, in his study of European and Siberian material, apparently met with similar difficulties (**1**, p. 30). In assigning a long series of specimens to *Martinellia mucronata* he states that he is not quite convinced that all of these specimens belong to one and the same species, since the material is not homogeneous. He prophesies, in fact, that the very critical *curta*-group may show itself unexpectedly rich in distinguishable species. The time is hardly ripe, however, to make further segregations, and a supposed new species in the group should be subjected to careful culture-methods before it is definitely proposed.

Attention has already been called to mod. *leptoderma* of *S. curta*, in which the distinctive leaf-borders of the *Curtae* are not differentiated. The mod. *parvifolia-laxifolia*, with which the leptodermous condition is often associated, represents, according to Buch (**3**,) a direct response to a diminished light supply, which casuses a lengthening of the internodes and, as a result, the separation of the leaves. In *S. mucronata*, *S. scandica*, and *S. lingulata*, however, a diminished light supply has little or no effect on the length of the internodes, although it does cause a diminution in the size of the leaves. These species, therefore may occur as mod. *parvifolia-densifolia* but not as mod. *parvifolia-laxifolia*. On account of these differences in response, which are to be regarded as specific in character, leptodermous modifications of *S. curta* with scattered leaves can, in many cases, be easily distinguished from leptodermous modifications of the *Immarginatae*, with which they might otherwise be easily confused.

5. Scapania lingulata Buch, Medd. Soc. F. et Fl. Fenn. **42**: 92. *f. 1–3.* 1916; Comm. Biol. Soc. Sci. Fenn. **3**[1]: 69. *f. 15.* 1928. *Martinellia lingulata* Arnell, Göteborgs Kungl. Vetenskaps- och Vitterhets-Samhälles Handl. 31. 1922.

On rocks or exposed soil, rarely on rotten logs, caespitose or accompanied by other bryophytes.

Maine: Thunder Hole, Mt. Desert, 1920 (*Miss Lorenz*), listed by Miss Lorenz as *S. curta* in Rhodora **26**: 6. 1924; Miss Lorenz listed *S. curta* also from a second Mt. Desert station, but her specimens (according to Buch) are depauperate and hardly referable to any definite species.

Buch cites *S. lingulata* from Amaralik, Greenland, where it was

found in 1830 by Vahl, but no other North American stations are known at the present time. The species is widely distributed in Finland, Sweden, and Norway and has been found once in Iceland. Although it is still unknown from Siberia, Buch thinks that it is probably circumpolar in its range.

The relationship between *S. mucronata* and *S. lingulata* is very close, and it is not surprising that the earlier writers failed to separate them. As distinguishing characters of the latter species Buch points out the following: the slightly larger size; the lingulate, rather than obovate, ventral lobes; the somewhat larger leaf-cells, which measure 20–26 μ along the margin, instead of only 14–20 μ as in *S. mucronata;* and the usual presence of scattered unicellular teeth, which are in the form of equilateral triangles.

In Buch's revised description of *S. lingulata* (**4**, p. 69) he states that the ventral leaf-lobes may be either rounded at the apex with an apiculum consisting usually of a single cell, or else more gradually sharp-pointed, and adds that the latter condition is more frequent in poorly developed plants. This account implies that the lobes are always pointed. The writer, from an examination of specimens from Finland and Sweden, as well as from Mt. Desert, finds that the ventral lobes, in the majority of cases, conform to Buch's description. In a few cases, however, the lobes are rounded but without apicula, and similar lobes are represented in one of Buch's figures (**4**, *f. 15*[3]).

Although the lobes of an occasional leaf may be entire throughout, marginal teeth are present in most cases and vary in number from one to seven on the ventral lobes and from one to five on the dorsal lobes. When a single tooth is present it usually marks the apex. The perianths of *S. lingulata* are lobed and ciliate at the mouth, and the green or reddish two-celled gemmae are oval, elliptical, or triangular. The perianths and gemmae, therefore, are much like those of *S. mucronata.*

Literature cited

1. **Arnell, H. W.** Die schwedischen Arten der Gattungen *Diplophyllum* und *Martinellia.* Göteborgs Kungl. Vetenskaps- och Vitterhets-Samhälles Handl. 1–80. 1922.

2. **Buch, H.** Studien über die Scapanien Fenno-Scandias. I. *Scapania curta*-Gruppe (vorläufige Mitteilung). Medd. Soc. F. et Fl. Fennica **42**: 85–96. *f. 1–12.*

3. ————. Die Scapanien Nordeuropas und Siberiens. I. Soc. Sci. Fennica Comm. Biol. **1**[4]: 1–21. *f. 1–11.* 1922.

4. ————. Die Scapanien Nordeuropas und Siberiens. II. Systematischer Teil. Ibid. **3**[1]: 1–173. *f. 1–39.* 1928.

5. **Evans, A. W.** Notes on New England Hepaticae,—V. Rhodora **9**: 56–60, 65–73. *pl. 73.* 1907.

6. ————. Notes on New England Hepaticae,—XI. Rhodora **16**: 62–76. 1914.

7. ———. Three species of *Scapania* from western North America. Bul. Torrey Bot. Club **57**: 87–112. *f. 1–8.* 1930.
8. **Kaalaas, B.** Beiträge zur Lebermoosflora Norwegens. Vidensk. Skrift. I. Math.-naturv. Kl. **1898**⁹: 1–28. *f. 1–7.*
9. **Lindberg, S. O., and Arnell, H. W.** Musci Asiae Borealis. Erster Theil. Lebermoose. Kongl. Svenska Vetensk.-Akad. Handl. **23**⁵: 1–69. 1889.

POLLINATION OF THE ERICACEAE: IV. LEDUM AND PYROLA

Harvey B. Lovell and John H. Lovell

Ledum groenlandicum Oeder

Ledum groenlandicum Oeder, Labrador tea, is occasionally abundant over small areas in damp acid soils in southern Maine. It is an upright evergreen shrub, from 3 to 10 dm. tall, with thick, oblong leaves, strongly revolute at the margins, which are densely rusty-woolly beneath, a provision, according to Kerner, against too rapid transpiration.

The small white flowers, which are slightly aromatic, are in terminal umbel-like clusters of ten to twenty-five flowers each, with two or three clusters at the end of each branch. The flowers are from 1.2 to 1.5 cm. broad. The stamens are usually five alternating with the petals, but frequently there are six, and in one instance there were eight. As *L. palustre* has normally ten stamens, the occurrence of extra stamens opposite the petals in *L. groenlandicum* may be a case of reversion.

The filaments are white, hairy at base, with yellowish anthers which open by terminal pores. The pollen is yellow and in tetrads. In mature buds 5 mm. long (Fig. 1, A) the stamens are 7 to 8 mm. long, their filaments bowed under tension, and spring or move upward when the petals are separated. The anther-pores open in the bud and pollen grains may be observed around these openings and on the stigma with which the anthers are in contact at this stage. It is probable that self-pollination occurs frequently in the bud. The flowers are nearly homogamous though showing a slight tendency to become protandrous.

The green capitate stigma, which bears five very small tubercles, remains persistent after the pollen has been shed. The ovary is likewise green and covered densely with short glandular hairs. Nectar is secreted sparingly by a green disc at the base of the ovary, where it is partially protected by the hairs on the filaments and ovary. It

slowly escapes between the filaments to the base of the petals. In fully expanded flowers (Fig. 1, B) the widely diverging stamens are 7 to 8 mm. long, while the erect style is one to two millimeters shorter. Self-pollination might still occur in lateral flowers, the pedicels of which were not erect.

The nectar is readily accessible to a wide variety of insects. Bumblebees alight directly on the center of the flowers, where their legs and

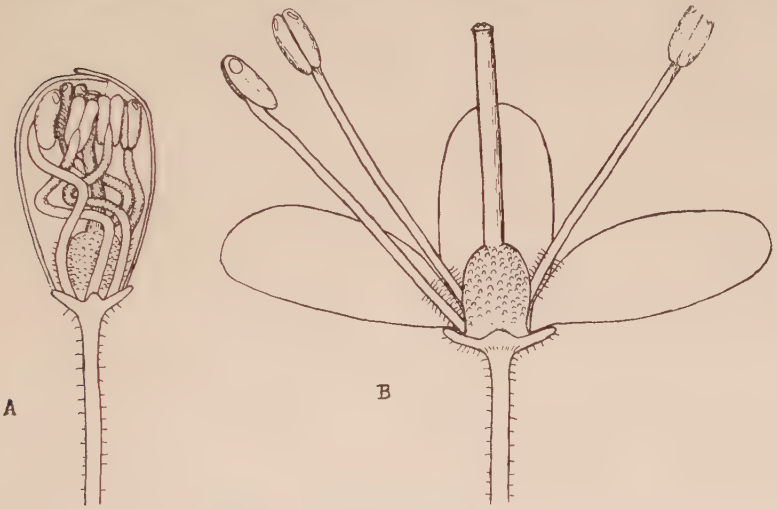

Fig. 1. Ledum groenlandicum: A, section of a mature bud, × 8; B, flower with 2 petals and 2 stamens removed, × 8.

the ventral side of the abdomen come in contact with the anthers, and effect pollination when they visit another flower. A few butterflies, the day-flying moth Thysbe, flies and beetles are occasional or rare visitors, but are of little importance as pollinators. We have been unable to verify Warming's statement that the flowers are occasionally anemophilous.[1]

The following insects were collected on the flowers from June 14th to July 1st at Waldoboro.

APOIDEA: Bombus ternarius Say ♀; B. terricola Kirby ♀ ♂; Andrena hippotes Rob. ♀; A. vicina Sm. ♀; A. sp. ♀; Osmia atriventris Cr. ♀.

LEPIDOPTERA: Pyrameis atalanta L; Hemaris thysbe Fab.

DIPTERA: Chilosia leucopareа Loew; Lucilia cornicina Fab.

COLEOPTERA: Agriotes stabilis Lec.

[1] Knuth, Blütenbiologie, Band II, Teil II, S. 47.

Pyrola elliptica Nutt.

Numerous observations have been made in Europe on the pollination of *Pyrola* and closely allied genera by Warming, Müller, Knuth,[1] and others; but there are no records for the American species, *P. elliptica* Nutt. and *P. americana* Sweet, which at Waldoboro, in southern Maine, are common in open sandy woodlands.

Shinleaf (*Pyrola elliptica*) is a perennial herb with basal elliptical leaves, from which rise an upright scape 1½ to 2 dm. tall, bearing from 5 to 14 nodding white flowers. The corolla has a breadth of 12 to 14 mm., and the petals are nearly or wholly separate. It is slightly irregular, the two upper petals standing close together during anthesis to protect the anthers, while the three lower are widely extended.

There are ten stamens, which are glabrous and awnless with the filaments attached to the anthers about 1 mm. below the pores. The anther is about 3 mm. long, two-beaked, with short tubes opening at the apex by an oval pore on each lobe. The pore-tubes are at first bright yellow becoming with age a reddish brown.

The ecology of the flower is divided into three distinct stages: in the first autogamy is prevented by the position of the anthers, in the second it becomes adapted to crossing, and in the third to automatic self-pollination. In mature buds the anthers stand close together around the stigma in an inverted position, resting on the outside of the filaments with the tubes pointing upward toward the ovary, as the flowers are nodding (Fig. 2[7]). The pores open in the bud, this upside down position preventing the escape of the pollen and self-pollination.

As the flower expands it becomes adapted to cross-pollination. As the result of the unequal growth of the upper end of the filament, the anther slowly capsizes, or is turned right side up, that is, it rotates over the end of the filament (Fig. 2[1, 2, 3]) and downward on its inner side so that the pores point away from the ovary, the anthers coming into a nearly horizontal position beneath the two upper petals.

The flower having expanded, the style lengthens downward until it lies nearly in the concave lower petal. The stigma is nearly flat, its five lobes only slightly developed, but the tip is moist and in a receptive condition (Fig. 2[4]). If it is visited by insects at this stage crossing may readily be effected. But long-continued collecting has yielded only six small Halictine bees, visiting the anthers only for pollen, which were not seen to touch the stigma, and one specimen of

[1] Knuth, Blütenbiologie. II, Teil 2, S s. 52.

Augochlora confusa. According to Knuth,[1] no insect visitors have ever been collected on the closely allied European *P. rotundifolia* L. Apparently cross-pollination is of rare occurrence. The flowers have a sweetish odor but are devoid of nectar.

During the final stage of anthesis autogamy may be brought about by a change in the position of the stigma. The five lobes now grow until they extend a millimeter beyond the ring at their base, and be-

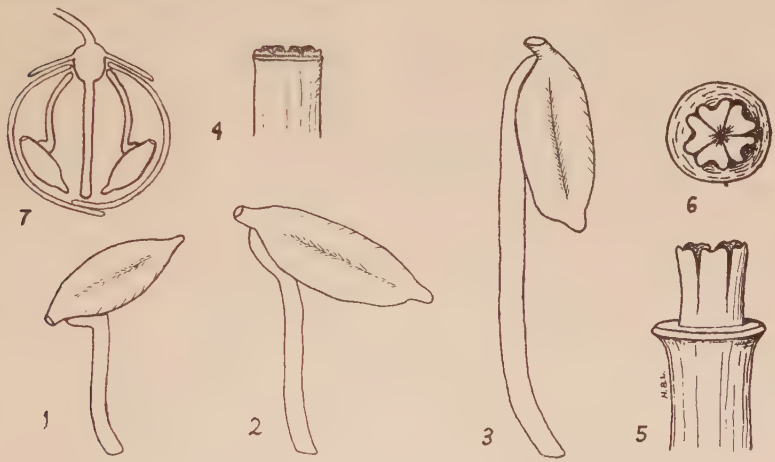

FIG. 2. PYROLA ELLIPTICA: 2^1, position of anther in bud, × 10; 2^2, position of anther in flower soon after opening, × 10; 2^3, position of anther in mature flower, × 10; 2^4, stigma in flower soon after opening, × 10; 2^5, stigma in mature flower, × 12; 2^6, end view of stigma of mature flower, × 12; 2^7, section of bud enlarged, showing position of anther.

come bifid at their tips and very viscid (FIG. $2^{5,6}$). The lengthening of the style and a slight curvature forward brings the stigma beneath the pores of the anthers. Then if the flower is shaken by the wind or by insects, the pollen falls freely on this large glutinous surface and self-pollination results.

As the result of long and careful observation the following visitors were captured on the flowers, collecting pollen, from July 17th to 19th.

APOIDEA: HALICTUS VIRIDATUS Lovell ♀, c. p.; H. PLANATUS Lov. ♀, c. p.; H. PILOSUS Sm. ♀, c. p.; AUGOCHLORA CONFUSA Rob. ♀, c. p.

Bombus ternarius Say, ♀, was twice seen to fly within an inch of a flower-cluster, but failed to alight.

[1] Knuth, Blütenbiologie, II, Teil 2, S. 53.

PYROLA AMERICANA Sweet

This species is closely allied to *P. elliptica*, but may be readily distinguished by its thick round leaves and longer sepals. Its flower ecology is essentially the same, but the stigmatic lobes are less elongated and do not show the bifid divisions found in the shinleaf. Although the flowers were under observation on several occasions for a long time both at Waldoboro and at the Knox Arboretum, Thomaston, where it is very common, no insect visitors were recorded.

WALDOBORO, MAINE.

NOTES FROM THE HERBARIUM OF THE UNIVERSITY OF WISCONSIN—XIII

NORMAN C. FASSETT

ASTRAGALUS CANADENSIS L., var. **longilobus**, n. var., calycis dentibus 2.5–5.5 mm. longis, tubo 4–5 mm. longo; calycibus et foliolis infra strigosis var. typicum simulantibus.—MINNESOTA: Willmar, July, 1892, *W. D. Frost* (Wis.[1]); Jefferson, July 20, 1889, *H. L. Lyons*, no. 257 (Minn.). IOWA: Decorah, July 13, 1881, *L. H. Pammel* (Ia.); common in thickets, along roadsides, etc., Chickasaw Co., July 11, 1926, *W. D. Spiker* (Ia.); Decatur Co., July 24, 1903, *J. P. Anderson* (Ia.). WISCONSIN: railroad cut, New Richmond, August 5, 1934, *N. C. Fassett*, no. 17104 (Wis.); Pine Bluff, August 6, 1889, *L. S. Cheney* (Wis.); Madison [about 1861], *T. J. Hale* (Wis.); Little Sturgeon, July, 1884, *J. H. Schuette* (Wis.; Field); sandy roadside, Binghampton, July 8, 1930, *W. E. Rogers*, no. 278 (TYPE in Herb. University of Wisconsin); roadside, low ground, Winchester, August 12, 1929, *N. C. Fassett & W. T. McLaughlin*, no. 9336 (Wis.). INDIANA: bank of Wabash River 1½ mi. south of East Mt. Carmel, rare here, June 18, 1918, *C. C. Deam*, no. 25469 (Deam); on wooded hillside east of Newburg, July 2, 1915, *Deam*, no. 16785 (Deam); wooded hills east of Winona Lake, Kosciusko Co., July 29, 1897, *Deam* (Deam; Field); 5 mi. northeast of Elkhart, July 2, 1921, *Deam*, no. 34424 (Deam).

The widespread typical *A. canadensis* has the calyx-lobes not more than one half the length of the tube (lobes 1–3 mm. long; tube 4.5–6 mm. long). *A. canadensis* var. *carolinianus* (L.) Jones,[2] of the southern Alleghenies, has the lobes usually more than half the length of the tube (lobes 2–3.7 mm. long; tube 4–5 mm. long). *A. canadensis* var.

[1] Specimens located as follows: Wis., University of Wisconsin; Minn., University of Minnesota; Ia., Iowa State College; Field, Field Museum of Chicago; Deam, Herbarium of C. C. Deam.

[2] Proc. Calif. Acad. ser. 2: v. 647 (1895).

longilobus is closely related to var. *carolinianus*, and often has the calyx-lobes better developed even than in that variety. In some individuals the lobes are longer than the tube, and on the specimen from Winchester, Wisconsin, an occasional lobe reaches 5.5 mm. in length and 2 mm. in width, and is distinctly foliaceous. The pubescence of var. *longilobus*, however, is identical with that of typical *A. canadensis*.

Oxytropis **chartacea**, n. sp., acaulis cespitosa; stipulis albis membranaceis, partibus connatis 7–15 mm. longis adpresse sericeo-villosis, partibus liberis 3–9 mm. longis glabris ciliatis; foliis 0.5–2.5 dm. longis, foliolis 9–17-jugis ovatis sericeo-pilosis, basi rotundis, saepe 2.3 cm. longis 7 mm. latis, margine subrevolutis; scapis 1.5–4 dm. longis sericeo-pilosis vel -villosis; spicis 3–12 cm. longis; bracteis calycem subaequantibus, subtus dense villosis, supra glabris vel glabratis; calycibus albo-tomentosis tubo 4–7 mm. longo, dentibus 1.5–3 mm. longis; corollis violaceis, deinde cyaneis; leguminibus suberectis chartaceis 1 cm. longis bilocularibus albo-pilosis saepe leviter nigro-pilosis; seminibus reniformis 1–1.2 mm. latis.—Wisconsin: sandy beach of Pigeon Lake, Drummond, July 19, 1928, *Ludlow Griscom;* same locality, July 28, 1934, *N. C. Fassett*, no. 16478; sandy shore of "Lake Huron," Plainfield, September 15, 1934, *Fassett*, no. 16704 (type in the Herbarium of the University of Wisconsin); sandy shore of Plainfield Lake, Plainfield, June 30, 1935, *S. C. Wadmond & N. C. Fassett*, no. 17386.

This species closely resembles *O. gaspensis* Fernald & Kelsey and *O. johannensis* Fernald. From the former it differs in its purple or blue flowers and villous bracts, and from the latter in its villous stipules and much smaller pods. From *O. Lamberti* and its relatives it differs in its papery pods, its densely tomentose calyx, its scapes with spreading pubescence, and the rounded bases of its leaflets.

Amphicarpa bracteata (L.) Fernald, var. **Pitcheri**, n. comb. *Glycine comosa* L. Sp. Pl. ii. 754 (1753), not *Falcata comosa* Am. Auct. *A. Pitcheri* T. & G., Fl. N. Am. i. 292 (1838).

In view of the doubt expressed by various writers, and indicated by numerous herbarium sheets with questioned determinations, of the distinctness of our two so-called species of *Amphicarpa*, it is surprising that varietal status for *A. Pitcheri* has not previously been proposed. Perusal of literature, and study in the herbarium and in the field, brings to light the following differences:

A. bracteata: stem with closely reflexed white or yellowish hairs; median stipules 3 mm. long; terminal leaflet 1.3–6 cm. long; inflorescence simple, 1–8-flowered; floral bracts 2–2.5 mm. long, the lower exceeded by the pedicels; calyx-tube 4–5 mm. long, the teeth short and broad; blade

of keel-petals longer than the claw; pod glabrous on the face, the pubescence of the lower suture antrorse toward the base; seeds 3.5 mm. long.

A. BRACTEATA var. PITCHERI: stems with mostly spreading, reddish, villous hairs; median stipules 4–5 mm. long; terminal leaflet 5–10 cm. long; inflorescence branched, 7–17-flowered; floral bracts 2.5–3.5 mm. long, the lower exceeding the pedicels; calyx-tube 4.5–6 mm. long, the teeth lanceolate; blade of keel-petals about equalling the claw; fruit strigose on the face, the pubescence of the lower suture retrorse toward the base; seeds 3.8–5.5 mm. long.

However, it is difficult to find a specimen which can be identified as one species or the other by all of these characters, and there is not sufficient correlation among any of them to warrant specific differentiation. Indeed, not one of these characters is of a clean-cut qualitative nature; var. *Pitcheri* is simply a vigorous, coarser, more villous form of *A. bracteata*. The ranges of the two are almost identical, *A. bracteata* extending farther northeastward, and var. *Pitcheri* going farther south, rarely into Mexico.

PETALOSTEMUM PURPUREUM (Vent.) Rydb., f. **pubescens** n. comb. *P. violaceum* var. *pubescens* Gray, Pl. Wright. i. 46 (1852), in part. *P. pubescens* Heller, Muhlenbergia i. 28 (August, 1901), in part, not *P. pubescens* A. Nels.

P. virgatum Scheele, Linnaea xxi. 461 (1848) is identified with this by Gray. *P. violaceum* var. *pubescens* as described by Gray was a mixture, the Wright and Lindheimer plants belonging to *P. pulcherrima* Heller (*P. virgatum* Scheele, not Nees & Schw.), but the Fendler plant, cited as type, is a pubescent phase of *P. purpureum*. This form, with tomentose stem and villous, gland-dotted leaves, is sporadic throughout the range of the species; there are specimens in the Gray Herbarium from Minnesota, Iowa, South Dakota, Nebraska, Oklahoma, Texas, Saskatchewan, Alberta, Montana, Wyoming, Colorado and New Mexico. *P. purpureum* var. *molle* (Rydb.) A. Nels. is a more well-marked local phase of the species, with the leaves practically without glands, and like the stem densely pilose.

DESMODIUM GRANDIFLORUM (Walt.) DC. As has been demonstrated by Blake[1] and by Schindler[2] *Hedysarum grandiflorum* Walt. was not the *D. grandiflorum* of recent manuals, but *D. bracteosum* (Michx.) DC. The latter name, however, should not be displaced by *D. grandiflorum*, for, as Blake pointed out, there was an earlier *H. grandiflorum* Pall.[3] The adoption, in 1930, of the "homonym rule" makes invalid the name *D. grandiflorum* as applied to any American plant.

[1] Bot. Gaz. lxxviii. 277 (1924).
[2] Fedde, Rep. xxii. 276 (1926).
[3] Reise ii. 743 (1773).

The *D. grandiflorum* of ed. 7 of Gray's Manual, then, becomes D. ACUMINATUM (Michx.) DC.,[1] while the *D. bracteosum* of Gray's Manual remains D. BRACTEOSUM (Michx.) DC.[2] The description of *H. bracteosum* Michx. includes the phrase "stipulis subulatis" which hardly applies to *D. bracteosum* as at present understood, but a copy of the Flora Boreali-Americana annotated by M. L. Fernald in the Michaux Herbarium bears the note "*bracteosum* OK," and Schindler appears also to have examined the type of *H. bracteosum*.

GLEDITSIA TRIACANTHOS L., forma **inermis**, n. comb. *G. triacanthos*, β. *inermis* Pursh, Fl. Am. Sept. i. 221 (1814).

Trees lacking the spines of ordinary *G. triacanthos* are of sporadic occurrence with the commoner type, and do not constitute a true variety.

The writer wishes to acknowledge the courtesy of the staff of the Gray Herbarium in making available to him the facilities of that institution.

MADISON, WISCONSIN.

NEW RUST SPECIES AND HOSTS FROM RHODE ISLAND

WILLIS R. HUNT

FORTY-TWO rust species, and fourteen hosts for thirty previously listed rusts, were reported for the first time as new to Rhode Island by the writer in *The Uredinales or Rusts of Connecticut and the other New England States* (Conn. State Geol. and Nat. Hist. Surv. Bul. 36: 1–198. 1926). The collections were made for the most part by Farlow of Harvard, Collins of Brown, and the author while studying rusts at Yale under Dr. G. P. Clinton. Numerous collections have been made since then by the writer, and five new rust species, two rust varieties, and five new hosts from this state are here reported for the first time. The specimens are in the writer's herbarium at Osborn Botanical Laboratory, Yale University.

In the treatment of rusts in this paper the sequence to show relationship other than that indicated by hosts, and nomenclature used by Arthur in the *Manual of the Rusts in the United States and Canada*, 1934, will be followed. The authorities for the hosts are those of

[1] For synonomy see Schindler, l. c., 258. He takes up *D. glutinosum* Muhl. for this species, but in view of the questionable priority of *D. glutinosum* over *H. acuminatum* it seems inadvisable to displace a name long familiar in American botanical literature.

[2] For synonomy see Schindler, l. c., 276.

Gray's Manual, 7th edition. Complete data will be given for each collection. An asterisk preceding the name of the rust indicates that it is new to the state; a double asterisk denotes that it is a new variety, and if only the host is new an asterisk will precede it.

* Uredinopsis mirabilis (Peck) Magn. On *Onoclea sensibilis* L.: II, Hopkinton, July 30, '35.

* Pucciniastrum myrtilli (Schum.) Arth. On *Gaylussacia baccata* (Wang.) K. Koch.: II, Exeter, Sept. 1, '31.

* Coleosporium vernoniae B. & C. On *Vernonia noveboracensis* (L.) Willd.: II, Hopkinton, July 30, '35.

** Puccinia andropogonis **pentstemonis** (Schw.) n. comb. *Aecidium Pentstemonis* Schw. Schr. Nat. Ges. Leipzig 1: 68. 1822. (Arthur, *Manual Rusts U. S. and Canada.* 120. (1934). Variety of *Puccinia andropogonis* Schw. On *Chelone glabra* L.: O–I, Westerly, July 16, '35.

Puccinia peridermiospora (Ellis & Tr.) Arth. On **Fraxinus americana* L.: O–I, Charlestown, Aug. 6, '35.

Puccinia seymouriana Arth. On **Cephalanthus occidentalis* L.: O, Westerly, July 16, '35.

** Puccinia rubigo-vera **agropyrina** (Erikss.) n. comb. *Puccinia agropyrina* Erikss. Ann. Sci. Nat. VIII. 9: 273. 1899. (Arthur, *Manual Rusts U. S. and Canada.* 180. 1934). Variety of *Puccinia rubigo-vera* (DC.) Wint. On *Thalictrum polygamum* Muhl.: O, Westerly, July 16, '35.

Puccinia xanthii Schw. On **Xanthium canadense* Mill.: III, Westerly, Sept. 14, '35.

Puccinia extensicola **solidaginis** (Schw.) n. comb. *Aecidium Solidaginis* Schw. Schr. Nat. Ges. Leipzig 1: 68. 1822. (Arthur, *Manual Rusts U. S. and Canada.* 198. 1934). Variety of *Puccinia extensicola* Plowr. On **Solidago sempervirens* L.: O–I, Block Island, July 17, '35.

* Puccinia limosae Magn. On *Lysimachia quadrifolia* L.: O–I, Westerly, July 16, '35; O–I, Hopkinton, July 30, '35.

Uromyces holwayi Lagerh. On **Lilium superbum* L.: III, Westerly, July 16, '35.

* Gymnosporangium ellisii (Berk.) Farl. On *Myrica carolinensis* Mill.: O–I, Charlestown, July 10, '32; O–I, Westerly, July 16, '35: III, Charlestown, July 10, '32. The telial stage was observed on *Chamaecyparis thyoides* (L.) B. S. P. but not collected.

Jenks Biological Laboratory,
Lafayette College,
Easton, Pennsylvania.

CORNUS DRUMMONDII

H. W. Rickett

Among the plants collected by Drummond in Louisiana in 1832 and now preserved in the herbarium of the Royal Botanic Garden at Kew is the specimen (No. 138) upon which C. A. Meyer founded *Cornus Drummondii*.[1] In Hooker's account of Drummond's collections it is listed as No. 366, *C. alba*.[2] The plant is evidently related to *C. asperifolia* Michx. The leaves, like those of the latter species, are rather broadly ovate with acuminate tips, and harsh above with minute appressed two-parted hairs. The pubescence of their lower surfaces, however, is composed of abundant straight appressed hairs, instead of the loosely spreading woolly hairs of *C. asperifolia*. These characters are noticed by Meyer in his description: "*foliis . . . late ellipticis ovatisve acuminatis basi rotundatis, subtus tuberculatis setisque (elongatis) bipartitis adpressis scabris dense incanis . . .*" He was apparently unfamiliar with *C. asperifolia;* the one plant which he saw that might be referred to that species he placed with *C. excelsa*.

C. asperifolia is rather variable in the shape of its leaves and in the degree of roughness of their upper surfaces; also in the size and shape of the stones of the white drupes. In their study of *Cornus*, Coulter and Evans distinguished by its rougher leaves and shorter stones a variety, which they found to be characteristic of the western parts of the range of the species. To this variety they applied Meyer's specific epithet *Drummondii*.[3] *C. Drummondii*, however, as is apparent from the specimen and from Meyer's description, is quite distinct from both typical *C. asperifolia* Michx. and var. *Drummondii* Coult. & Evans.

The species or variety represented by Drummond's plant has escaped further notice. Meyer cited a specimen from Texas (*Wiedmann*). Two specimens in the herbarium of the Missouri Botanical Garden seem to be the same; one collected by *Fendler* at New Orleans in 1846, the other by *C. R. Ball* near Alexandria, Louisiana, in 1899. Collections have been recently made by *Drouet* near Columbia, Missouri, which present similar characters. Some of these specimens, however, exhibit a scantier pubescence and a somewhat smaller leaf than *C. Drummondii*, and in these respects resemble the more pubescent forms of another variable species, *C. racemosa* Lam. (*C.*

[1] Mem. Acad. Imp. Sci. St. Petersb. **7:** 210 (1846).
[2] Comp. Bot. Mag. **1:** 48 (1835).
[3] Bot. Gaz. **15:** 36 (1890).

paniculata L'Her., *C. candidissima* of various authors, probably not Miller). The cymes and fruits of this species are quite similar to those of *C. asperifolia,* the cymes perhaps usually less ample, the stones of the drupes more globular, less inclined to be oblique and flattened. The pedicels are in general longer (2–5 mm.) than those of *C. asperifolia* (1–3 mm.). The leaves are smaller, more elliptical, and vary from glabrous to more or less pubescent on either or both surfaces with appressed two-parted hairs.

The existence of forms intermediate between the well known species of *Cornus* has long been ascribed to hybridization. The sporadic occurrence of *C. Drummondii* suggests that it may be a hybrid of the two species between which it is intermediate. Against this it must be advanced that *C. racemosa* is apparently infrequent in the regions where *C. Drummondii* has been collected. It is interesting, however, to note that the plants from this vicinity which have been referred to *C. Drummondii* were collected not far from plants of *C. racemosa,* which is rare here. It is well known that *C. racemosa* is connected by a series of intermediate forms with the more southern *C. stricta* Lam.

Several investigators have lately called attention both to the importance of hybrids in an understanding of plant populations and to the dangers of a too easy decision that intermediate forms are indeed hybrids. It is perhaps worthy of more general recognition that hybridity, in relation to taxonomy, may mean two different things. An initial cross may lead to the formation of fertile races, which may be constant, as in such genera as *Hieracium* and *Galeopsis,* or which may exhibit Mendelian segregation and give rise to a host of fertile but inconstant forms, as in certain species of *Viola.* Or the hybrid may be sterile or nearly so, and its occurrence limited to the first generation and to the proximity of the parents. It is in the latter sense that *C. Drummondii* may possibly be a hybrid. In any case, further collection should provide valuable information on its status.

Department of Botany,
University of Missouri.

Volume 38, no. 446, including pages 53–76 and plate 407, was issued 3 February, 1936.

NOTICE TO SUBSCRIBERS

Subscription revenue covers less than one-half the total cost of publication of RHODORA. The strictest economy will be necessary to permit future publication on the same modest scale as has obtained in recent years.

About one-third of our subscribers file their renewal orders through commercial subscription agencies which habitually deduct 10% from every remittance as a commission.

Many remittances reach the management in the form of drafts or checks which are subject to bank collection and exchange charges of varying amounts, owing to Clearing House rules.

Beginning January 1, 1932, the subscription rate to RHODORA will be $2.00 *net* per annum payable in Boston or New York funds or their equivalent (i. e. drafts or postal money orders which are collectible in Boston at par). All subscription orders from agencies must be accompanied by remittances at the *net* rate without deduction. Hence all subscribers who require the convenience of agency service must regard the subscription rate to RHODORA as $2.00, plus the charges of agents.

NOTICE TO CONTRIBUTORS

IN accordance with the Editorial Announcement of March, 1931, that RHODORA will follow the provision of the International Rules of Botanical Nomenclature, that the publication of names of new groups will be valid only when they are accompanied by a Latin diagnosis, contributors are notified to see that all new species or other groups proposed by them for publication in RHODORA have Latin diagnoses. If desired by contributors, the Editorial Board of RHODORA will undertake (with charges at cost for matter of considerable length) to have their English diagnoses converted into Latin.